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The EBIT quest for better transition probabilities of forbidden lines

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Electron beam ion traps (EBIT) offer spectroscopical access to highly charged ions practically rest, using a room-sized apparatus with auxiliary equipment. Ion species and charge-state ranges can be chosen or adjusted by ion source and electron beam energy setting. SuperEBIT at LLNL is particularly versatile in this, permitting electron energies from 100 eV to 250 keV. After switching the electron beam off, ions can be kept stored for seconds in the magnetic trapping mode, permitting time-resolved studies. The combination of spectroscopy in the visible range with the capability for lifetime measurements in the millisecond range makes this device extremely useful for the investigation of forbidden transitions which are of great interest for the diagnostics of fusion-oriented plasmas. We have begun exploratory spectral and lifetime studies of rare gases like Ar, Kr, and Xe, which yield forbidden lines bright enough to dominate the spectra [1]. Our lifetime measurements on forbidden lines in the visible spectrum have reached a precision of about 5%, which may be sufficient for some applications. Some EBIT lifetimes measured on x-ray transitions, however, are better than 1% already. Our aim, therefore, is to reach such a precision also for forbidden transitions in the visible spectral range, where such data would test details of theoretical calculations.

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